Application No.: 10/088,894 Docket No.: 20459-00351-US

REMARKS/ARGUMENTS

Bearing in mind the comments in the official action and the amendments and remarks submitted hereinbelow, the application is now believed to be in condition for allowance. An early indication of the same would be appreciated.

Claims 21-37 are now pending in this application. Claims 21, 25, and 30 are independent. Claims 1-20 have been canceled, and claims 21-37 have been added by this amendment. No new matter is implicated by any new claim.

Drawing Objections

Withdrawal of the objection to the Drawings is requested. A proposed Drawing Correction is filed concurrent with this Amendment in response to the objection stated in paragraph 2 of the Official Action regarding the absence of identification of ***spindle 24 in Fig. 5***.

With respect to the objections to the Drawings stated in paragraph 1 of the Official Action, the undersigned traverses these objections, and offers the following comments in support of the position that Drawing correction is not needed as concerns the following elements:

1) ***electric motor 2*** finds support in the Specification at least at p. 6, lines 20-21;

2) ***bevel gear 2a*** finds support in the Specification at least at p. 9, line 7;

3) ***planetary gear 13*** finds support in the Specification at least at p. 10, line 13; and

4) ***energy accumulator 7*** finds support in the Specification at least at p. 6, lines 38-39.

Objection to the Specification

Withdrawal of the objections to the Specification set forth in paragraphs 3 and 4 of the Official Action is requested. Responsive to the objections, headings have been added as requested, and element number "3" has been corrected to read "2" at p. 6, line 27 of the Specification.

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Objection for lack of Abstract f the Disclosure

Withdrawal of the objection to the disclosure as not containing an Abstract of the Disclosure is requested. Responsive to the objection, an Abstract is provided on a separate sheet as an attachment to this Amendment. The undersigned avers that no new matter is implicated by submission of this Abstract.

Claim Rejections

Withdrawal of the rejection of claims 1-20 under 35 U.S.C. §112, second paragraph, as being indefinite, is requested. Claims 1-20 have been canceled, thus rendering their rejection moot.

Withdrawal of the rejection of claim 15 under 35 U.S.C. §112, first paragraph, as lacking written description support in the Specification, is requested. Claim 15 has been canceled, thus rendering its rejection moot.

Withdrawal of the rejection of claims 1 and 5 under 35 U.S.C. §102(b) as being anticipated by Cotter et al. (US 2,399,722) is requested. Claims 1 and 5 have been canceled, thus rendering their rejection moot.

Withdrawal of the rejection of claims 1 and 5 under 35 U.S.C. §102(b) as being anticipated by Sullivan et al. (US 5,261,310) is requested. Claims 1 and 5 have been canceled, thus rendering their rejection moot.

However, Applicant further notes that anticipation requires the disclosure, in a prior art reference, of each and every limitation as set forth in the claims.[1] There must be no difference between the claimed invention and reference disclosure for an anticipation rejection under 35 U.S.C. §102.[2] To properly anticipate a claim, the reference must teach every element of the claim.[3] "A claim is anticipated only if each and every element as set forth in the claim is found, either expressly or inherently described, in a single prior art reference".[4] "The identical

[1] *Titanium Metals Corp. v. Banner*, 227 USPQ 773 (Fed. Cir. 1985).
[2] *Scripps Clinic and Research Foundation v. Genentech, Inc.*, 18 USPQ2d 1001 (Fed. Cir. 1991).
[3] *See* MPEP § 2131.
[4] *Verdegaal Bros. v. Union Oil Co. of Calif.*, 2 USPQ2d 1051, 1053 (Fed. Cir. 1987).

invention must be shown in as complete detail as is contained in the ...claim."[5] In determining anticipation, no claim limitation may be ignored.[6]

New Claims

New claims 21-37 have been drafted to avoid the indefiniteness rejections and the alleged anticipatory applied art. Consideration and allowance of these new claims is requested. These claims correspond, essentially in most respects, to originally presented claims 1-17.

With respect to the now moot §112, first paragraph rejection of claim 15 in paragraph 8 of the Official Action, now corresponding in many respects to newly-presented claim 35, the Examiner's attention is invited to the Specification at least at p. 13, line 17 through p. 14, line 7 for a description of the operation of this embodiment.

With respect to the previous anticipation rejection of claims 1 and 5, new claims 21 and 25 are not anticipated by the previously applied art, as Cotter et al. and Sullivan et al. do not disclose all the elements and arrangement recited at least in pending independent claims 21, 25, and 30.

Attached hereto is an Abstract of the Disclosure, a marked up copy of the Specification, and a Proposed Drawing Correction.

In view of the above, each of the presently pending claims 21-37 in this application is believed to be in immediate condition for allowance. Accordingly, the Examiner is respectfully requested to withdraw the outstanding rejection of the claims and to pass this application to issue.

In the event the Examiner believes that an interview would be helpful in resolving any outstanding issues in this case, the undersigned attorney is available at the telephone number indicated below.

Although extensions of time are not believed to be necessary with this communication,

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[5] *Richardson v. Suzuki Motor Co.*, 9 USPQ2d 1913, 1920 (Fed. Cir. 1989).
[6] *Pac-Tex, Inc. v. Amerace Corp.*, 14 USPQ2d 187 (Fed. Cir. 1990).

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the Director is hereby authorized to charge any fees, or credit any overpayment, associated with this communication, including any extension fees or fees for excess claims, to CBLH Deposit Account No. 22-0185.

Respectfully submitted,

By Larry J. Hume

Larry J. Hume
Registration No.: 44,163
CONNOLLY BOVE LODGE & HUTZ LLP
1990 M Street, N.W., Suite 800
Washington, DC 20036-3425
(202) 331-7111
(202) 293-6229 (Fax)
Attorneys for Applicant

Encl: Abstract of the Disclosure
Marked up Copy of Specification
Proposed Drawing Correction

Method and arrangement for loading artillery pieces by means of flick ramming

BACKGROUND OF THE INVENTION

The present invention relates to a method and an arrangement for flick ramming shells and propellant powder charges in artillery pieces which are loaded with these components separately.

The expression flick ramming means that the components making up the charge, in the form of shells and propellant powder charges, are, during the start of each loading operation, imparted such a great velocity that they perform their own loading operation up to ramming in the barrel of the piece in more or less free flight at the same time as the loading cradle in which they are accelerated to the necessary velocity is rapidly braked to a stop before or immediately after it has passed into the loading opening of the barrel.

Flick ramming is an effective way of driving up the rate of fire even in heavier artillery pieces, and, in this connection, it is in general terms necessary for the shells, for example, to be imparted a velocity of at least approaching 8 metres per second in order for flick ramming to be performed. It is moreover desirable that the ramming velocity can be varied in relation to the elevation of the piece so that the shells are always rammed equally firmly in the loading space of the piece. This is because, in this way, variations of Vo, that is to say the muzzle velocity, as a result of shells/projectiles being rammed with varying degrees of firmness are avoided.

The major problem associated with flick ramming heavier artillery shells/projectiles is that of accelerating these to the necessary final velocity within the acceleration distance available, which is usually no longer than the length of the shell or projectile itself. Furth rmore, it must be possible to flick ram different types of shell/projectile of

different weight and length using one and the same rammer. A further complication in flick ramming shells/projectiles, and to a certain extent in flick ramming propellant powder charges, is that, as soon as they have reached the desired velocity, the rammer or the shell cradle with which they have been accelerated to the desired flick ramming velocity must be rapidly braked to zero while the accelerated shell or propellant powder charge continues its course forwards and into the loading opening of the piece as a freely moving body.

Thus far, the practice has primarily been to use pneumatically driven flick rammers in which a pneumatic accumulator provided the necessary energy to impart the requisite flick velocity to the shell in question. In conventional rammers which do not provide flick ramming, there are often chain transmissions for transferring the energy supply between an axially displaced hydraulic or pneumatic piston and the rammer which acts directly on the rear part of the shell.

US 4,457,209, in which chiefly Figs 12 and 18 are of interest, can be cited as an example of a hydraulically driven shell rammer, while US 4,957,028 constitutes an example of a purely piston-driven rammer.

SUMMARY OF THE INVENTION

The present invention relates to an electrically driven flick rammer for artillery pieces. The rammer according to the invention is to begin with characterized in that, for the acceleration of the shells and, where appropriate, the propellant powder charges, it utilizes the starting acceleration from an electric motor, the rotating movement of which is mechanically geared down and converted into a rectilinear movement. According to a development of the invention, it is moreover possible, when necessary, to make use of an extra energy supply from a chargeable energy accumulator which has previously been provided with an energy supply and is then triggered simultaneously with the driving electric motor of the

the electric motor, the other parts of the rammer then following. In addition to the electric motor and the energy accumulator, the rammer according to the invention also requires a locking function which ensures that the energy accumulator is triggered at the correct moment, that is to say simultaneously with the electric motor being started. In this connection, the motor can be used to provide the locking function. The part referred to above as the energy accumulator can advantageously consist of a compressible spring means in the form of one or more interacting coil or pneumatic springs of a type known per se provided that it is possible to achieve sufficient energy accumulation capacity with these.

As already indicated, the basic idea of the electric motor-driven rammer, with its energy accumulator for making possible ramming of even heavy shells, allows scope for a number of different detailed embodiments. There are therefore a number of different ways in which the accelerating rotation of an electric motor can be converted into a likewise accelerating rectilinear movement, at the same time as there are a number of different ways of embodying the energy accumulator. A few different preferred ways of embodying the arrangement according to the invention will therefore be described in greater detail below. One of the examples described also comprises, in addition to the basic concept of the invention, a development of the same which makes possible mechanical gearing-up of the ramming velocity to a higher level than is achieved according to said basic concept. The variants described in connection with the appended figures are, however, to be seen only as examples of a few embodiments of the invention, while the latter is as a whole defined in the patent claims below.

BRIEF DESCRIPTION OF THE DRAWINGS

In the figures described below:

Fig. 1 shows the basic principle of the invention,

DESCRIPTION OF PREFERRED EMBODIMENTS

Fig. 2 shows the same variant as in Fig. 1 but in an angled projection and with some component parts omitted so as to clarify the main principle,

Figs 3 and 4 show a second variant of the invention in an angled projection and two different operating positions,

Figs 5, 6 and 7 show angled projections of a third variant of the invention, Fig. 5 showing the arrangement with the shell in the starting position, Fig. 6 the arrangement with the shell in the launching position and Fig. 7 the main component parts of the drive system with the shell in the starting position,

Figs 8 and 9 show a lateral projection and, respectively, a vertical view of another embodiment of the invention, and

Fig. 10 shows the section X-X in Fig. 8.

Fig. 1 shows diagrammatically the basic principles of the invention in its simplest variant as far as ramming shells is concerned. In the figure, the shell has the reference number 1, while 2 indicates the electric drive motor and 3 the drive wheel of the motor. A feed chain 4 runs around the drive wheel 3 and also around a chain wheel 5 which is driven by the chain but is considerably larger than the wheel 3 and will therefore rotate at a considerably lower speed. By using the feed chain 4, the rotating movement of the electric motor 2 and then chiefly its starting acceleration which is the motor movement of which use is mainly made in application of the invention, is therefore converted into a linear movement which is transmitted to the shell 1 via a shell rammer 6. The acceleration imparted to the shell therefore originates from the starting acceleration of the electric motor. However, the great weight of the shell 1 makes it necessary to provide additional energy as otherwise the motor would have to be exceptionally large, and, according to the invention, this extra energy supply is provided by energy accumulated in an energy accumulator 7 at an earlier stage being released at the same time

as the electric motor 2 is started. In its simplest form, the energy accumulator 7 consists of a coil or pneumatic spring which is compressed in its charged state. To trigger the energy accumulator, a locking system 8 is included, as indicated in the figure, which is operationally linked to the starting of the electric motor and which is disconnected at the same time as the electric motor 2 is supplied with starting current. The locking system 8 can advantageously, before starting, be replaced by the motor 2 being loaded in the braking direction, that is to say the direction in which it locks or counteracts the energy accumulator, after which the current direction is switched and increased to its maximum value at the same time as the energy accumulator 7 is triggered. This starting method results in an even more rapid start and therefore greater shell acceleration. To transmit the energy supply from the energy accumulator 7 to the feed chain 4 and thus to the rammer 6 and finally to the shell 1, there is also a second feed chain 9 which runs around on the one hand a guide wheel 10 and on the other hand a drive wheel 11, the latter being mounted firmly on the same spindle as the chain wheel 5 and therefore in turn driving it. When the electric motor 2 is started, the energy supply from the motor is imparted to the feed chain 4, and at the same time the energy accumulator 7 therefore delivers its energy supply, also to the feed chain 4, via the second feed chain 9, the combined energy supply from these two energy sources accelerating the shell 1 in the direction of the arrow A to a velocity which is sufficiently high for the shell to proceed to ramming in the ramming position of the piece (not shown). As soon as the shell has achieved the necessary velocity, the rammer 6 is braked to a stop, which takes place at the latest in line with the spindle of the drive wheel 3. The fact that the electric motor has an important role to play in the system can also be used in order to brake the ramming velocity of the shell if the energy supply from

the energy accumulator should be too great in any position. Electronically controlling an electric motor using, for example, a velocity sensor as a point of reference is after all a simple routine procedure today. The simplest way of recharging the energy accumulator is, moreover, to reverse the electric motor until it has returned to the original position.]

Fig. 2 shows in principle the same arrangement as in Fig. 1 but in an angled projection and without the motor 2. In this case, it is assumed that the motor 2 is used to keep the system locked up to the start, for which reason the locking system 8 has been omitted. Otherwise, the various component parts have been given the same reference numbers as in Fig. 1. The motor 2 (not shown) is therefore assumed to be coupled to the drive wheel 3 and thus to drive it via the feed chain 4 running around the wheel 5, to which chain the shell rammer 6 is fixed. The second feed chain 9 runs around the guide wheel 10 and the drive wheel 11 which is mounted firmly on the same spindle as the wheel 5, while the body of the pneumatic spring 7a is fixed in a stand (not shown) and its piston rod is connected to the feed chain 9 which it drives in the direction of the arrow A1 when it is released. A number of additional arrows, which indicate the movements of the various feed chains 4 and 9, have also been included in the figure. As can be seen from the figure, starting the motor 2 (not shown) therefore results in the shell 1 being accelerated in the direction of the arrow A1 by the combined starting acceleration from the motor 2 (not shown) and the pneumatic spring 7a. To recharge the energy accumulator, that is to say the pneumatic spring 7a, all that is necessary is for the motor 2 to be reversed until the pneumatic spring has been compressed again, after which the system is locked by motor braking and the system is ready for a new operating sequence. It is assumed that, during its acceleration, the shell 1 rests in a system-integral shell cradle which can be in the form of a completely